

The increase of diabetes mortality burden among Brazilian adults

Sandhi Maria Barreto,¹ Valeria Maria Azeredo Passos,¹
Suzanne Kelly Ferreira Almeida,¹ and Tiago Duarte Assis¹

Suggested citation

Barreto SM, Passos VMA, Almeida SKF, Assis TD. The increase of diabetes mortality burden among Brazilian adults. *Rev Panam Salud Publica*. 2007;22(4):239–45.

ABSTRACT

Objective. To estimate diabetes-related deaths among Brazilian adults between 1999 and 2003 and to investigate demographic factors associated with reporting diabetes as an associated cause of death.

Methods. All deaths with diabetes as the underlying or associated cause were identified using the Brazilian Mortality Data System. Analysis was performed by sex, age, year, state of residence, and place of death. Mortality rates were age standardized by the 2000 Brazilian population.

Findings. A total of 237 946 deaths (8.8%) were related to diabetes; in 4.2% of deaths it was the underlying cause and in 4.6% it was an associated cause. Between 1999 and 2003, age-standardized mortality rates for diabetes as the underlying cause increased 14% among males and 9% among females, while mortality with diabetes as an associated cause increased 22% and 28%, respectively. Diabetes appeared more often as an associated cause in death certificates among older individuals and in those residing in São Paulo State; it appeared less often as an associated cause among women, brown- and black-skinned populations, and in deaths occurring outside hospitals. Cardiovascular diseases accounted for 54.5% of the underlying causes of death when diabetes was an associated cause.

Conclusion. Diabetes was related to almost 9% of the deaths in the South and Southeast regions of Brazil. Mortality from diabetes is increasing, especially deaths with diabetes as an associated cause. The probability of having diabetes as the underlying cause of death is greater among women and nonwhite individuals. Our results reinforce the importance of using multiple causes of death to monitor diabetes, because half the individuals with the disease will die of another cause, especially cardiovascular diseases.

Key words

Diabetes mellitus; mortality; causes of death; death certificates; Brazil.

Type 2 diabetes is one of the 10 leading causes of death in the world. World Health Organization estimates

(1) indicate a rapid increase in the prevalence of the disease worldwide, especially in developing countries, as a result of aging and of nutritional changes in these countries. Between 1995 and 2025, diabetes prevalence in the population 20 years old or older may have increased around 335% in Latin America. In 1998, Brazil had about 4.9 million adults with diabetes.

In 2025, that number is expected to reach about 11.6 million (2).

Diabetes is an important predictor of premature mortality as it is associated with a substantial increase in mortality from all causes, especially coronary heart diseases (3–7). Adverse effects of diabetes extend to all components of the cardiovascular system—the microvasculature, the larger arteries, and

¹ Universidade Federal de Minas Gerais, Av. Prof. Alfredo Balena 190, Belo Horizonte, MG 30130-100, Brazil. Send correspondence to: Sandhi Maria Barreto, Universidade Federal de Minas Gerais, Av. Prof. Alfredo Balena 190, Belo Horizonte, MG 30130-100, Brazil; telephone: 55 31 32489938.

the heart—as well as to the kidneys. In the United States, it is estimated (6) that diabetes is responsible for at least 3.6%–5.1% of all adult deaths and for 5.2%–6.8% of adult deaths due to cardiovascular diseases. However, death certificates appear to underestimate the importance of diabetes among adults, showing a biased picture of the disease and causes of death among those with diabetes (8, 9).

Few studies exist on the evolution of diabetes-related mortality in Brazil (10–12). National mortality estimates are based on a simple analysis of the underlying cause of death listed on death certificates. However, patients with type 2 diabetes who are adequately treated usually die of chronic complications of the disease, which are considered secondary causes on the death certificate (8). Thus, the importance of diabetes as a cause of death is underestimated in studies based solely on underlying causes of death.

The quality of data on mortality varies in Brazil and must be considered to obtain a reliable estimate of diabetes-related mortality. In 2001, mortality system coverage (13) was 93% in the South region of the country, 89% in the Southeast, 84% in the Center-West, 72% in the Northeast, and 66% in the North. Moreover, the proportion of deaths from ill-defined conditions was high in the North and Northeast regions (13). For these reasons, this study was restricted to mortality data from the South and Southeast regions.

This study aims to: (1) estimate mortality from diabetes as an underlying and associated cause of death in adults residing in the South and Southeast regions between 1999 and 2003, (2) investigate whether the presence of diabetes as an associated cause on death certificates varies according to selected sociodemographic characteristics, and (3) identify the main underlying causes of deaths related to diabetes.

MATERIALS AND METHODS

Data were obtained from the Brazilian Mortality Information System,

which provides underlying cause of death, date, location of death, and selected characteristics of the deceased. The analysis presented in this manuscript was approved by the Departments of Social and Preventive Medicine and Internal Medicine of the Faculty of Medicine, Federal University of Minas Gerais. Data on mortality do not identify individuals and are freely accessible on the Internet without approval from the Ministry of Health.

All deaths of adults aged 30 years or older residing in the South and Southeast regions of Brazil between 1999 and 2003 were analyzed. The Southeast region is the most developed and populous area in the country (14), with 72 412 411 inhabitants, 42.64% of the Brazilian population (169 799 170 inhabitants), living in four states: São Paulo (37 032 403 inhabitants), Minas Gerais (17 891 494 inhabitants), Rio de Janeiro (14 391 282 inhabitants), and Espírito Santo (3 097 232 inhabitants). The South region of the country accounts for 14.8% of the Brazilian population living in three states: Rio Grande do Sul (10 187 798 inhabitants), Paraná (9 563 458 inhabitants), and Santa Catarina (5 356 360 inhabitants).

All deaths with underlying cause codes E10 to E14 of the Tenth Revision of the International Classification of Disease (ICD-10) were selected. The presence of diabetes as an associated cause of death was investigated by searching for codes E10 to E14 in all parts of the death certificate (15): in part I on lines Ia (disease or pathological disorder leading to death), Ib (disease or condition causing the immediate cause of death), Ic (the condition present before and leading to the intermediate or immediate cause of death), and Id (filled whenever there is more than one cause regarded as Ib, in which case it is placed in line Ic); and in part II (disease(s) that may have contributed to the death but were not part of the main causal sequence).

Any death with diabetes mentioned in any part of the death certificate was selected and included in the analysis of diabetes as an associated cause. The underlying causes of death in the

records that mention diabetes as an associated cause were also identified and grouped by ICD-10 chapter. Information on age, sex, skin color (as reported in the death certificate: white, brown, black, and other), federative unit of residence, and place of death (hospital, household, or other) was obtained. Data were processed and analyzed by Stata (16).

To control for the effect of age distribution variations in the study period and among capitals, mortality rates by sex were directly standardized, having as references the population age distribution in the 2000 demographic census. Mortality trends related to diabetes in the period studied were investigated graphically.

The effect of selected variables on diabetes-related death was tested using Pearson's χ^2 test. Multiple logistic regression analysis (17) was used to investigate the association between these selected factors and reporting diabetes as an associated cause, adjusting for age and sex. The magnitude of the associations was measured by an odds ratio with 95% confidence intervals.

RESULTS

Between 1999 and 2003, 237 946 diabetes-related deaths occurred, which corresponds to 8.8% of the total deaths in that period. In total, 4.2% of death certificates had diabetes as the underlying cause and 4.6% had it as an associated cause. Diabetes, as an associated cause, appeared mainly in part II of the death certificate—that is, as a significant condition contributing to death but not an underlying cause. In these cases, the frequencies with which diabetes appeared in part II of the death certificate were 87.3%, 90.1%, 91.3%, 93.4%, and 93.5% in 1999 to 2003, respectively.

For the 5 years studied, the crude mortality rate from diabetes as an underlying cause remained relatively stable, around 50 per 100 000 inhabitants. However, the crude mortality rate based on diabetes as an associated cause of death increased 11%: from 52.5 per 100 000 inhabitants in 1999 to

58.4 per 100 000 in 2003. In absolute numbers, total deaths from diabetes as an underlying cause increased from 21 300 to 23 628 and deaths reporting diabetes as an associated cause rose from 21 598 to 27 094.

Table 1 shows annual age-standardized mortality rates related to diabetes for each sex. Higher mortality rates were observed for females. In the 5-year period, rates for diabetes as an underlying cause increased 14% among males and 9% among females. Rates based on deaths with diabetes as an associated cause increased even more: 22.2% for males and 27.8% for females.

The mortality rates by age for each sex are shown in Table 2. When the initial and final age groups are compared, a > 100-fold increase in mortality rate is observed for both sexes, regardless of whether diabetes is an underlying or an associated cause of death.

Table 3 shows the distribution of deaths related to diabetes by selected characteristics obtained from death certificates. There is a clear discrepancy in the distribution of death among the states; in São Paulo, mortality was higher for diabetes as an associated cause, while in Rio de Janeiro and Minas Gerais it was higher as an underlying cause. Diabetes was more commonly reported as an associated cause of death among people classified as white or other skin color (which includes mainly people of Japanese origin) than among those declared as having black or brown skin color. Diabetes as an associated cause of death also occurred more frequently in hospitals than elsewhere.

Table 4 shows the results of the analysis comparing deaths with diabetes as an associated cause with deaths having diabetes as an underlying cause, before and after adjustment by all the other factors in the table. Diabetes as an associated cause was significantly less frequent among women and was more prevalent in older age groups. It remained lower in the brown and black populations and among deaths occurring outside the hospital. Compared with São Paulo

TABLE 1. Age-standardized diabetes-related mortality (rate per 100,000 inhabitants) by sex, South and Southeast Brazil, 1999–2003^a

Year	Female		Male	
	Underlying cause	Associated cause	Underlying cause	Associated cause
1999	52.97	50.80	41.98	45.83
2000	57.75	58.95	46.52	50.16
2001	55.29	59.56	44.70	50.95
2002	57.37	62.91	46.05	54.31
2003	57.65	64.94	47.84	56.02

^a Rate was standardized by the Brazilian population in 2000.

State, the other states were less likely to report diabetes as an associated cause of death.

Cardiovascular diseases accounted for 54.5% of the underlying causes when diabetes is mentioned as an associated cause, respiratory diseases for 16%, and cancer for 10.9%. Among cardiovascular diseases, coronary heart disease (ICD-10 I20–I25) was the most frequent underlying cause of death, accounting for around 36.6% of these deaths in 2003.

DISCUSSION

The analysis of the role of diabetes as an underlying or associated cause of death in populations of states in the South and Southeast regions of Brazil shows that diabetes-related mortality in Brazil is twice as high as that inferred only by the underlying cause of death and that the distribution between underlying and associated cause varies among states, by socio-

demographic characteristics, and by place of death.

In death certificates reporting diabetes, its proportion as the underlying cause of death is far higher in Brazil than that found in longitudinal studies (11) and in mortality studies in developed countries (18). In the United States (19), diabetes appears as an associated cause in about two-thirds of the death certificates that mention diabetes anywhere. The same is observed (20) in studies of cohorts of diabetic individuals, in which fewer than one-third of deaths report diabetes as the underlying cause.

It is possible that data obtained from death certificates underestimate the real importance of diabetes in the country, especially as a contributing cause of death, as observed (18–22) in some developed countries.

Age standardization revealed a real increase in mortality rates based on diabetes as an associated cause in the study period. Part of such an increase possibly reflects improvements in the

TABLE 2. Diabetes-related mortality rates by age group and according to position of diabetes on the death certificate in men and women, South and Southeast Brazil, 2000^a

Age (years)	Male		Female	
	Underlying cause	Associated cause	Underlying cause	Associated cause
30–39	3.91	3.03	2.88	2.00
40–49	13.79	11.77	9.79	8.25
50–59	45.59	45.59	43.09	38.61
60–69	120.48	129.28	122.45	122.77
70–99	231.62	271.15	267.53	285.96
≥80	343.14	411.06	471.48	521.16

^a Rate per 100,000 inhabitants.

TABLE 3. Distribution of deaths related to diabetes according to its position on death certificate and by selected characteristics in adults residing in South and Southeast Brazil, 1999–2003

Characteristic ^a	Diabetes on death certificate				Total number of deaths	AC – UC %
	Underlying cause (UC)		Associated cause (AC)			
	N	%	N	%		
Sex ^b						
Male	48 102	46.89	54 485	53.11	102 587	6.22
Female	65 774	48.61	69 547	51.39	135 324	2.78
Age group (years) ^c						
30–39	2 468	55.99	1 940	44.01	4 408	–11.98
40–49	7 152	54.39	5 998	45.61	13 150	–8.78
50–59	17 081	50.70	16 607	49.30	33 688	–1.40
60–69	29 779	49.05	30 933	50.95	60 712	1.90
70–79	36 834	48.73	38 755	51.27	75 589	2.54
≥ 80 years	23 084	46.79	26 250	53.21	49 334	6.42
State of residence ^d						
São Paulo	35 967	40.12	53 660	59.88	89 627	19.76
Minas Gerais	22 562	54.77	18 633	45.23	41 195	–9.54
Espírito Santo	5 889	55.27	4 767	44.73	10 656	–10.54
Rio de Janeiro	26 106	55.20	21 190	44.80	47 296	–10.40
Paraná	10 454	59.56	7 097	40.44	17 551	–19.12
Santa Catarina	4 511	49.67	4 552	50.23	9 063	0.56
Rio Grande do Sul	11 020	50.81	10 667	49.19	21 687	–1.62
Skin color ^e						
White	74 831	46.84	84 943	56.17	159 774	9.33
Black	9 858	55.41	7 933	44.59	17 791	–10.82
Brown	16 810	53.59	14 577	46.41	31 387	–7.18
Other	1 357	43.49	1 763	56.51	3 120	13.02
Place of death ^f						
Hospital	91 494	47.04	103 005	52.96	194 499	5.92
Domicile	17 916	57.60	13 186	42.40	31 102	–15.20
Other	3 417	55.02	2 793	44.98	6 210	–10.04

^a Ignored: 11.12% for skin color and 4.29% for place of death.

^b Pearson $\chi^2 = 130.43$, $P < 0.0001$.

^c Pearson $\chi^2 = 374.78$, $P < 0.0001$.

^d Pearson $\chi^2 = 9.80$, $P < 0.001$.

^e Pearson $\chi^2 = 15.0$, $P < 0.0001$.

^f Pearson $\chi^2 = 15.0$, $P < 0.0001$.

recording of associated causes on death certificates, supporting the idea of underestimation of diabetes as a contributory cause on death certificates. On the other hand, a real increment in mortality from diabetes cannot be denied. The increased incidence in the disease observed in many countries and the strong relationship to aging and to obesity also has a positive impact on mortality as cohorts with a higher incidence of diabetes are reaching older ages. Though suggestive, it cannot be asserted that the incidence of diabetes has been increasing in Brazil because of the lack of population-based studies of the disease.

When comparing data from a study (11) on mortality from diabetes as an underlying and an associated cause in

the State of São Paulo in 1992, a real increment in mortality from diabetes may be inferred. That year, of a total 202 141 deaths in the state, diabetes was mentioned on 13 786 (6.8%) certificates: 2.6% as underlying cause and 4.2% as associated cause of the total deaths. In 2000, 20 934 deaths from diabetes were recorded in the state, six times more than in 1992, representing 10.3% of the total deaths that occurred that year. However, the percentage distribution of deaths referring to diabetes as an underlying and an associated cause was similar: 38.5% and 61.5% in 1992 and 40.1% and 59.9% in 2000, respectively.

The observed increase in the frequency with which diabetes appears as an associated cause of death may re-

fect real differences in disease survival and improvements in filling out death certificates. Studies in developed countries in the 1980s and 1990s (20, 23–25) show that diabetes was referred to as a contributory cause in fewer than 40% of the death certificates of diabetic patients. The distribution of diabetes-related mortality in São Paulo is similar to that in developed countries (26), which suggests better disease control in the state, leading to a reduction in premature mortality, which more often attributes diabetes as an underlying cause.

An increase in the presence of diabetes as an associated cause on death certificates related to age is observed in numerous longitudinal studies and partially indicates greater death risk from

TABLE 4. Characteristics associated with reporting diabetes as a contributory cause on death certificate, South and Southeast Brazil, 2003

Characteristic	OR ^a	95% CI ^b	Adjusted OR ^c	95% CI
Sex				
Male	1.00	NA ^d		NA
Female	0.96	0.93–0.99	0.95	0.91–0.98
Age (years)				
30–39	1.00	NA	1.00	NA
40–49	1.43	1.2191–1.70	1.44	1.20–1.73
50–59	1.52	1.30–1.79	1.50	1.27–1.78
60–69	1.79	1.53–2.09	1.81	1.54–2.13
70–79	1.82	1.56–2.13	1.82	1.54–2.14
≥80	1.82	1.56–2.13	1.83	1.55–2.16
Skin color				
White	1.00	NA	1.00	NA
Black	0.67	0.63–0.72	0.73	0.68–0.79
Brown	0.73	0.69–0.77	0.79	0.74–0.83
Other	1.26	1.06–1.50	1.04	0.87–1.24
Place of death				
Hospital	1.00	NA	1.00	NA
Household	0.56	0.53–0.560	0.56	0.53–0.59
Other	0.91	0.84–0.99	0.77	0.70–0.84
State of residence				
São Paulo	1.00	NA	100	NA
Minas Gerais	0.56	0.53–0.59	0.61	0.57–0.65
Espírito Santo	0.60	0.54–0.68	0.66	0.58–0.76
Rio de Janeiro	0.52	0.49–0.55	0.54	0.52–0.57
Paraná	0.51	0.48–0.55	0.53	0.50–0.57
Santa Catarina	0.69	0.63–0.75	0.71	0.64–0.78
Rio Grande do Sul	0.57	0.54–0.61	0.55	0.52–0.59

^aOdds ratio obtained by multiple logistic regression comparing deaths having diabetes as an associated cause with those having diabetes as the underlying cause.

^bConfidence interval.

^cOdds ratio adjusted by all factors in the table.

^dNot applicable.

the disease and its direct complications for young adults. At the same time, an increase in the prevalence of comorbidities with age is expected. It is estimated that, of the 7.5 million diabetes-related deaths in the world in 2000, 4.6 million occurred for reasons other than diabetes. For individuals aged 35–69, 59% of deaths were attributed to diabetes, while for individuals over 64 with diabetes, only 29% of deaths were attributed to the disease (9).

This study identified a significant variation in the frequency with which diabetes is mentioned as a related cause of death according to age, sex, skin color/race, place of residence, and place of death. Similar variations have also been reported in the United States and may be attributed to systematic bias affecting information quality and completeness, from medical diagnosis to final coding and pro-

cessing of the underlying cause of death. If a death certificate lists only one cause, then it must be selected as the underlying cause and there will not be multiple causes in such a case (22). If diabetes were underreported as a contributory cause in states other than São Paulo, then the real burden of diabetes mortality would be even greater and would increase in the near future, as reporting of multiple causes tends to improve.

The cause of death depends on the history of the disease that led to death. If we consider that the reporting of multiple causes of death is a proxy for the level of familiarity between the death certifier and the patient, then it can be expected that a death that occurs in a hospital, compared with deaths away from a hospital environment, will more often contain information on associated causes of death,

possibly because of better documentation of the patient's health. Our results support this hypothesis.

When we analyze mortality by sex, a larger proportion of male deaths under 60 years is observed, with inversion at more advanced ages, for diabetes as an underlying cause and as an associated cause. Several studies have shown that mortality from diabetes varies with age and sex. Lower female mortality is observed for young adults both with and without diabetes, with inversion at more advanced ages. In a study in the United States (21), median life expectancy for females with diabetes at 55–64 years of age was 17 years compared with 10 years for males with diabetes in the same condition and the same age. However, diabetes prevalence is usually higher in females than in males and the risk of death associated with the disease is also higher in females than in males (6). Based on longitudinal studies in several developed countries (9), the relative risk has been estimated at 4.05, 2.86, and 1.46 for males in the 20–39, 50–59, and 60–79 age groups and at 6.72, 3.54, and 2.25 for females in the same age groups, respectively.

The greater probability of the presence of diabetes as the underlying cause of death in females, in people with brown or black skin, and in deaths occurring away from a hospital environment observed in the present study has also been reported in a study (19) on the factors associated with the report of multiple causes of death in the United States. Such findings suggest that factors other than those expected in the disease's natural history operate in the certification of causes of death. On the other hand, if we consider that the selection of diabetes as an associated cause of death is a desirable proxy for better control of the disease, and therefore for the reduction in precocious mortality from its direct complications, our results suggest a worse prognosis of the disease for women and nonwhites in the country. Because odds ratios tend to overestimate the magnitude of the association in cross-sectional studies, especially when the prevalence of the condition being ana-

lyzed is high, we also calculated prevalence ratios (27). Compared with the odds ratios displayed in Table 4, the prevalence ratios obtained by Poisson regression were slightly smaller than the corresponding odds ratios and confidence intervals were narrower, but the directions of the associations remained the same (data not presented).

The predominance of cardiovascular diseases as the underlying cause in deaths of which diabetes is an associated cause is expected for several reasons and has already been reported in the country. In Recife (12), in the Northeast region of the country, cardiovascular diseases were the underlying cause of death in most diabetic

patients over age 50 and of acute complications in most diabetic patients under age 50. The risk of cardiovascular disease is markedly higher in diabetic patients, with a prevalence twice as high as that in the general population (28, 29). A U.S. study (21) found that coronary disease, cerebrovascular disease, and other heart diseases account for 25.4%, 7.75%, and 2.9% of underlying causes from the total death certificates in which diabetes appears in any position. A meta-analysis of 37 cohorts (4) found a 3-fold greater risk of a fatal coronary event in diabetic individuals than in people without diabetes (5.6 and 1.6), with the relative risk for people with

diabetes being 50% higher for females than for males.

In conclusion, diabetes is a serious disease, with multiple complications and premature mortality being related to almost 9% of the deaths in the first and third most densely inhabited regions of Brazil (South and Southeast). The importance of using multiple causes of death to monitor diabetes is clear, as more than half the individuals with the disease will die of another cause, especially cardiovascular diseases. Our results show that women and nonwhites die more often from the disease itself. Possible inequalities in reporting the causes of death should be investigated.

REFERENCES

- World Health Organization. Diabetes Programme [Web site]. Available from: <http://www.who.int/diabetes/en/>. Accessed 8 March 2007.
- King H, Aubert RE, Herman WH. Global burden of diabetes, 1995–2025: Prevalence, numerical estimates and projections. *Diabetes Care*. 1998;21(9):1414–31.
- Lotufo PA, Gaziano JM, Chae CU, Ajani UA, Moreno-John G, Buring JE, et al. Diabetes and all-cause and coronary heart disease mortality among US male physicians. *Arch Intern Med*. 2001;161(2):242–7.
- Huxley R, Barzi F, Woodward M. Excess risk of fatal coronary heart disease associated with diabetes in men and women: meta-analysis of 37 prospective cohort studies. *BMJ*. 2006;332(7533):73–8.
- Hu FB, Stampfer MJ, Solomon CG, Liu S, Willett WC, Speizer FE, et al. The impact of diabetes mellitus on mortality from all causes and coronary heart disease in women: 20 years of follow-up. *Arch Intern Med*. 2001;161(14):1717–23.
- Saydah SH, Eberhardt MS, Loria CM, Brancat FL. Age and burden of death attributable to diabetes in the United States. *Am J Epidemiol*. 2002;156 (8):714–9.
- Whiteley L, Padmanabhan S, Hole D, Isles C. Should diabetes be considered a coronary heart disease risk equivalent? *Diabetes Care*. 2005;28(7):1588–93.
- McEwen LN, Kim C, Haan M, Ghosh D, Lantz PM, Mangione CM, et al. Diabetes reporting as a cause of death: Results from the Translating Research Into Action for Diabetes (TRIAD) study. *Diabetes Care*. 2006;29(2):247–53.
- Roglic G, Unwin N, Bennett PH, Mathers C, Tuomilehto J, Nag S, et al. The burden of mortality attributable to diabetes. Realistic estimates for the year 2000. *Diabetes Care*. 2005;28(9):2130–5.
- Coeli CM, Ferreira LGFD, Derbal MM, Veras RP, Camargo KR Jr, Cascão AM. Diabetes mellitus mortality among elderly as an underlying or secondary cause of death. *Rev Saude Publica*. 2002;36(2):135–40.
- Laércio FJ, Mameri C, Pagliaro H, Iochida LC, Goldenberg P. Diabetes as underlying or associated cause of death in the State of S. Paulo, Brazil, 1992. *Rev Saude Publica*. 1998;32(3):237–45.
- Melo SM, Lolio CA, Lucena MAF, Kirzner CF, Martins SM, Barros MNDS. Multiple causes of death in diabetic individuals in the Brazilian Northeastern Region. *Rev Saude Publica*. 1991;25(6):435–42.
- Ministry of Health. Brazil Health 2005: An analysis of health situation at Brazil [Web site]. 2005. Available from: http://portal.saude.gov.br/portal/arquivos/pdf/saude_brasil_2005.pdf. Accessed 24 January 2007.
- Brazilian Institute of Geography and Statistics [Web site]. Available from: <http://www.ibge.gov.br/home>. Accessed 15 January 2007.
- Morritt NA, Hall J. Completing a death certificate. *BMJ Career Focus*. 2004;328:217.
- Stata Statistical Software [computer program]. Release 8.0. College Station, TX: Stata Corporation; 2002.
- Hosmer DW, Lemeshow S. *Applied logistic regression*. New York: John Wiley and Sons; 1989.
- Boyko EJ. Progress in the estimation of mortality due to diabetes. *Diabetes Care*. 2005;28(9):2320–1.
- Wall MM, Huang J, Oswald J, McCullen D. Factors associated with reporting multiple causes of death. *BMC Med Res Methodol*. 2005;5(1):4.
- Tseng CH. Mortality and causes of death in a national sample of diabetic patients in Taiwan. *Diabetes Care*. 2004;24:1605–9.
- Penman A. Excess mortality due to diabetes in Mississippi and the estimated extent of underreporting on death certificates. *J Miss State Med Assoc*. 2004;44(10):219–52.
- Whittall DE, Glatthaar C, Knuiman MW, Welborn TA. Deaths from diabetes are underreported in national mortality statistics. *Med J Aust*. 1990;152(11):598–600.
- Vauzelle-Kervroedan F, Delcourt C, Forhan A, Jouglu E, Hattton F, Papoz L. Analysis of mortality in French diabetic patients from death certificates: a comparative study. *Diabetes Metab*. 1999;25(5):404–11.
- Thomason MJ, Biddulph JP, Cull CA, Holman RR. Reporting of diabetes on death certificates using data from the UK Prospective Diabetes Study. *Diabet Med*. 2005;22(8):1031–6.
- Gu K, Cowie CC, Harris MI. Mortality in adults with and without diabetes in a national cohort of the U.S. population, 1971–1993. *Diabetes Care*. 1998;21(7):1138–45.
- Will JC, Vinicor F, Stevenson J. Recording of diabetes on death certificates: Has it improved? *J Clin Epidemiol*. 2001;54:239–44.
- Barros AJ, Hirakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. *BMC Med Res Methodol*. 2003;20:3–21.
- Report of Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care*. 2003;26(Suppl 1):S5–20.
- Zachary T, Bloomgarden MD. Consequences of diabetes. *Cardiovascular disease*. *Diabetes Care*. 2004;27:1825–31.

Manuscript received 8 March 2007. Revised version accepted for publication 9 July 2007.

RESUMEN

Aumento de la carga de la mortalidad por diabetes en adultos brasileños

Objetivos. Estimar las muertes relacionadas con la diabetes en adultos brasileños entre 1999 y 2003 y analizar los factores demográficos asociados con el informe de la diabetes como causa asociada de muerte.

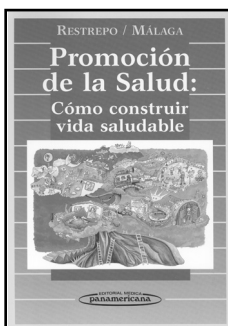
Métodos. Se identificaron todas las muertes en que la diabetes fue la causa principal o asociada, a partir del Sistema Brasileño de Datos de Mortalidad. El análisis se realizó según el sexo, la edad, el año, el estado de residencia y el lugar de muerte. Las tasas de mortalidad se estandarizaron por la edad según la población brasileña en 2000.

Resultados. En total, 237 946 muertes (8,8%) estuvieron relacionadas con la diabetes; en 4,2% de las muertes, la diabetes fue la causa principal y en 4,6% fue una causa asociada. Entre 1999 y 2003, las tasas de mortalidad estandarizadas según la edad para las muertes en que la diabetes fue la causa principal aumentaron 14% en hombres y 9% en mujeres, mientras que la mortalidad con la diabetes como causa asociada aumentó a 22% y 28%, respectivamente. La diabetes apareció más frecuentemente como causa asociada en los certificados de defunción de las personas de mayor edad y en los que residían en el Estado de São Paulo, mientras que fue menos frecuente en mujeres, negros y mestizos y cuando la muerte ocurrió fuera de los hospitales. Las enfermedades cardiovasculares fueron la causa principal de 54,5% de las muertes en las que la diabetes se consideró como causa asociada.

Conclusiones. La diabetes estuvo relacionada con casi 9% de las muertes ocurridas en las regiones sur y suroriental de Brasil. La mortalidad por diabetes está en aumento, especialmente cuando la diabetes figura como causa asociada de muerte. La probabilidad de tener diabetes como causa principal de muerte es mayor en mujeres y en personas que no son blancas. Estos resultados confirman la importancia de utilizar la información de las múltiples causas de muerte para analizar la diabetes, ya que la mitad de las personas con esta enfermedad morirá por otra causa, especialmente por enfermedades cardiovasculares.

Palabras clave Diabetes mellitus, mortalidad, causas de muerte, causa de muerte, certificado de defunción, Brasil.

Promoción de la salud: cómo construir vida saludable



Con el noble empeño de despertar conciencia sobre la importancia de "construir salud" mediante la promoción de la salud, los autores de este libro hacen un aporte inestimable a las instituciones y personas que tienen la responsabilidad de fomentar el bienestar de las poblaciones. En América Latina se hace imprescindible el trabajo dirigido hacia la promoción de la salud, como única opción para reducir las brechas existentes en la salud y el bienestar de las personas.

Este libro profundiza los conceptos teóricos y prácticos de la promoción de la salud como meta para avanzar en la búsqueda de la equidad en los niveles locales, con la aplicación de diversas estrategias adaptadas a los entornos en que las personas viven y trabajan.

2001 • 298 pp. • ISBN 958 9181 55 4 • Código: OT 129 • Precio: US\$ 20 en América Latina y el Caribe y US\$ 25.00 en el resto del mundo

Realice su pedido y pago en dólares estadounidenses a: <http://publications.paho.org>; correo electrónico: paho@pmds.com; Fax: (301) 209-9789; Oficina de país de la OPS/OMS